Distance Learning-Ancient Life at Grand Canyon

Grand Canyon Geology

Distance Learning Program

Last revised: 12/3/15 (we review and update our lesson plans annually. Latest versions can be found online at http://www.nps.gov/grca/learn/education/learning/ancient-life.htm)

Pre-program: Print the "Fossilization" game cards prior to your scheduled distance learning program. They can be found on our website at: http://www.nps.gov/grca/forteachers/learning/ancient-life.htm

Grand Canyon Focus: Fossils
School Subject: Earth Science
Grade Levels: 2nd -5th
Length: 60 minutes

National Standards Addressed:

Our programs are aligned to National Science Standards, Next Generation Science Standards, and Common Core. For a full listing of all the standards this program addresses please follow the link at the top of the page and open the Ancient Life Standards PDF.

Lesson Overview

Over the years, the environments have Grand Canyon have changed. These changes are reflected in the rock layers and fossils that we find here at Grand Canyon. Student can use the clues that are in the fossils and make inferences to decipher past environments of Grand Canyon based on what they know about today's environments.

Lesson Objectives

Students will be able to:

- List several examples of Grand Canyon's fossils
- List rock types and the environments in which they form.
- Give examples of environmental changes over geologic time.
- Recognize the vastness of geologic time represented by Grand Canyon's rock layers.

Materials

Fossilization game cards

Background Information:

Fossils:

The Kaibab Limestone was deposited by a shallow, warm water sea (100-200' deep) with mild currents. It has been dated at approximately 270 million years old. Most of the fossils found are filter feeders that lived on the sea floor (sponges, brachiopods, corals, bryozoan, and crinoids). Sharks teeth have been found as well.

A fossil is any evidence of ancient life. This evidence may be the actual remains, such as bone, teeth, shells or plant tissues; chemically altered remains; or traces of the activities of organisms, such as burrows and tracks. Paleontology is the study of fossils, and scientists who study fossils are paleontologists. Paleontologists use fossils to reconstruct ancient life, using what we know about the present to understand the past and drawing upon the sciences of geology and biology. Paleontology is often confused with archaeology, which is the study of ancient humans and their cultures. The focus of paleontology is the history of life on earth, from its beginnings approximately 3.6 billion years ago to the present. Except for rare occurrences, fossils are found only in sedimentary rocks.

Upon death, most plant and animal remains are soon digested by bacteria and other living organisms. Thus some of the organic elements of life are recycled to build new organisms. Rare and special circumstances are necessary for any parts or traces of an organism to be preserved as a fossil. Preservation usually requires that an organism or its remains be buried rapidly, be insulated from oxygen and decay-producing organisms, and remain buried and undisturbed. Under even the best of conditions, the preservation of soft parts is exceptionally rare. Usually only hard skeletal elements are preserved as fossils.

Fossils are not always the actual remains of living organisms. Many fossils are just copies called imprints, molds, or casts. Imprints are impressions made by organisms in soft sediment that were preserved when the sediment solidified. Imprints can be traces of an animal's activity, rather than its actual remains. The hardened tracks of animals or the burrows of prehistoric worms in solidified mud are examples of fossil imprints. Molds are made when organisms are totally or partially buried in sediment that hardens into rock. Over time, ground water may dissolve the organisms, leaving cavities shaped like their bodies. Both imprints and molds are mirror images of the organisms. If a mold was later filled with mud or mineral material, the hardened filling is called a cast. It is a reproduction that has the same outer shape as the organism. A cast looks like the organism itself, not like its imprint. Paleontologists make casts of fossil molds by filling them with liquids, such as plaster, that harden.

Geologic Time:

The earth is very old — about 4½ billion years — according to recent estimates. This vast span of time, called geologic time by earth scientists, is difficult to comprehend in the familiar time units of months and years, or even centuries. How then do scientists reckon geologic time, and why do they believe the Earth is so old? The evidence for an ancient Earth is concealed in the rocks that form the Earth's crust and surface. The rocks are not all the same age—or even nearly so—but, like the pages in a long and complicated history, they record the Earth-shaping events and life of the past. The record, however, is incomplete. Many pages, especially in the early parts, are missing and many others are tattered, torn, and difficult to decipher. But enough of the pages are preserved to reward the reader with accounts of astounding episodes which certify that the Earth is billions of years old.

The oldest known rocks on Earth are close to four billion years old. They are found on the shores of Great Slave Lake in Canada's Northwest Territory and in remote areas of Greenland. The rock layers of Grand Canyon range in age from 1.8 billion years (1,800 million years) old at the bottom of the canyon to 270 million years old at the top. The metamorphic rocks, found at the bottom of the canyon formed when sedimentary rocks were subjected to extreme heat and pressure. Igneous intrusions can be found throughout the metamorphic complex. Sedimentary rock layers above them tell us of a time where we had ancient oceans, deserts and swamps. The canyon seen today is relatively young, having been sculpted in just the last 5-6 million years. The Colorado River carved through many rock layers to create Grand Canyon. Lateral erosion widened the canyon.

Procedure: The rangers will discuss the following concepts as listed in the slides below:

Slide 1-3. Introduction to National Parks and what they protect.

The ranger will show the National Park symbol and discuss the meaning of its parts. Next, the ranger will give the students an introduction to Grand Canyon National Park. (aerial videos of park)

Slide 4-5: Ancient Life at Grand Canyon

What do you think of when you hear the word fossil? Students will share their answers.

Slide 6: Fossils are time machines

To learn about the past we have to understand the present so that we can make comparisons between the two and know what the past might have looked like.

Slide 7: FOSSIL Slide
The ranger will share the acrostic poem: Fantastically Old Stone-like Specimen Indicating Life

Slide 8: Who wants to become a fossil?
The ranger will lead the class through the Fossilization Game and explain how fossils are created only under certain conditions. In general, an organism dies and the creature or plant is quickly covered in sediment with little to no oxygen. Through time minerals are replaced to turn the organism into rock. The process is quite rare.

Slide 9-10: Paleontologists
The ranger will lead a discussion that describes the scientists who study fossils and the skills they use in the field.

Slide 11: Optical illusion slide
Paleontologists use their observation skills to make inferences. This optical illusion slide helps students understand that we can see things in different perspectives. Kids see either a saxophone player or a woman's face.

Slide 12-14: Observations vs. Inferences
Fossils in rock are not always clear so you need to look at them from many angles and use your imagination to infer what they were. Students compare shells of the past to shells of the present to make correlations between the two.

Slide 15: Rock Layers of Grand Canyon
Ranger will play video of rock layers in Grand Canyon and show a stratigraphic column.

Slide 16-18: Coconino Sandstone
The ranger will show the students a picture of the Coconino sandstone in Grand Canyon and ask the students what types of environments they find sand. Students will see pictures of desert and coastal environments and compare them to the environment of the past and today.

Slide 19-22: Mudstone
The ranger will show the students a picture of the Hermit Shale in Grand Canyon and ask the students what types of environments they find shale or mud. Students will see pictures of a tidal flat, lake, and swamp environment and compare them to the environment of the past and today.

Slide 23-28: Marine Environments
The ranger will show the students pictures of marine environments and discuss how they can vary in depth and chemical properties. Students will see pictures of a shallow, muddy, ocean or sea environment and compare them to the environment of the past and today.

Slide 29: Ancient Environments of Grand Canyon
The ranger will highlight the stratigraphic column and the diversity of ancient environments found at Grand Canyon.

Slide 30: Conclusion
The students will have 10 minutes to ask the ranger questions.